



Z CORPORATION®

# 3DP Consumables Catalog



Part Number 09572  
Rev. B

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## Introduction

Z Corporation® offers several material systems to satisfy a variety of modeling needs. This guide is designed to give users an overview of the different types of powders, binder and infiltrants that can be used with 3D printers. The part numbers associated with each product are also listed.

These material choices allow you to tailor the properties of the finished models by selecting different infiltrants based on the application.

No matter which material you choose, you will always get the fast, high quality, and low material cost printing our machines are known for.

The affordable ZPrinter 310 Plus, the full-color Spectrum Z510 and the brand new ZPrinter 450.



### Printers and Materials Compatibility Chart

Printing System	High Performance Composite			Direct Metal Casting	Investment Casting	Elastomeric	
	zp® 130/zb® 59	zp® 131/zb® 60	zp® 140/zb 60	ZCast®/zb® 56	zp®14/zb® 51	zp® 15e/zb 51	zp 15e/zb 58
ZPrinter® 310 Plus	-	X	X	X	X	X	-
ZPrinter® 450	X	-	-	-	-	-	-
Spectrum Z™ 510	-	X	X	X	-	-	X
Compatible Infiltrants							
Infiltrant Name	High Performance Composite			Direct Metal Casting	Investment Casting	Elastomeric	
Z-Bond™ 101/ Z-Bond™ 90	X	X	X	-	-	-	-
Z-Max™ Epoxy	X	X	X	-	-	-	-
Wax	X	X	X	-	X	-	-
Z-Bond 11	-	-	-	-	X	-	-
Elastomer Kit	-	-	-	-	-	X	X
Water	-	-	X	-	-	-	-

## 2.0 The Building Blocks of 3D Printing

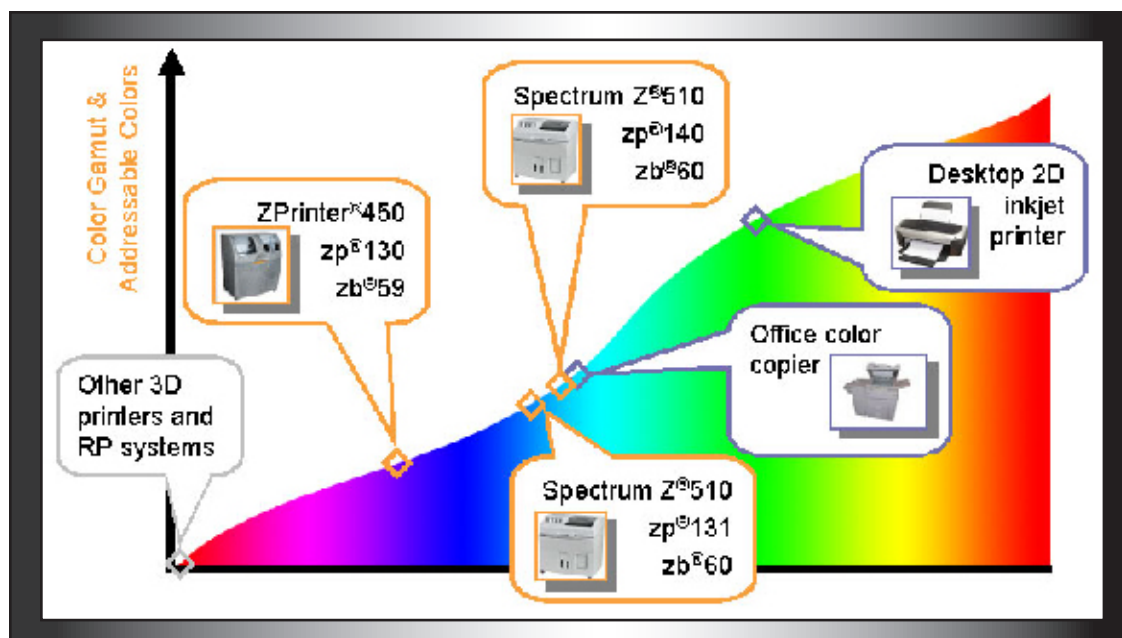
The foundation of 3DP technology is the High Performance Composite Material. It consists of a highly engineered powder with numerous additives that maximize surface finish, feature resolution, and part strength. Each material, paired with its corresponding binder, produces high-definition parts that are fit for the most demanding 3D printing application. The materials are ideal for:

- High strength requirements
- Delicate or thin-walled parts
- Color printing
- Accurate representation of design details

High Performance Composite Materials are specifically designed to take advantage of the heater modules in the current generation of printers. The final green strength (the strength of an uninfiltreated part) makes it easy to remove your model from the build bed and to handle it during infiltration. When your parts come out of the printer, you can expect them to be stronger than comparable parts printed with a previous generation of materials.

Refer to the color gamut chart below on our product line comparison to other 3D printers and RP systems in the market as well as desktop printers. zp 131 has a smaller color gamut than zp 140 but great for color textures and light tones. If you need the highest green strength to print fine-featured models and you use Z-Bond 101 as your main infiltrant, zp 131 is the material that is the most likely to meet your expectations. On the other hand, if what you need is an easy-to-use material, amazing color, clean whites and the Water Cure option to make 3D Printing safe and affordable, zp 140 is your material of choice. More information on each powder is addressed in the next sections of this manual.

High Performance Composite Material Comparison Chart				
		zp 131	zp 140	zp 130
Model Strength	Feature Resolution	****	***	***
	Green Strength	****	**	***
	Strength (Z-Bond)	****	**	**
Color & White	Addressable Colors	****	****	**
	Consistent Colors	***	***	**
	Whiteness	***	****	**
Ease of Use & Office Compatibility	Fast Drying	***	****	**
	Low Dustiness	****	***	*
	Water Cure	NO	YES	NO



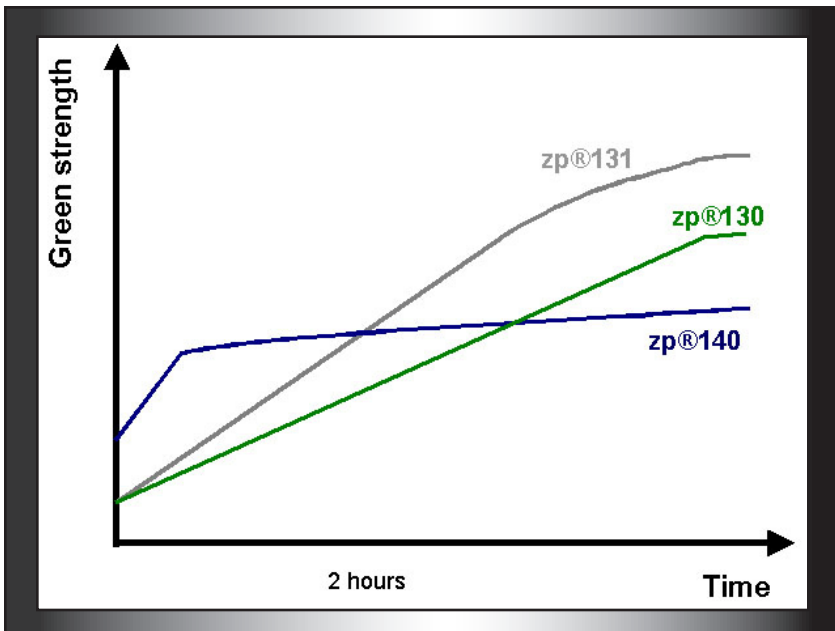
## 2.1 zp 130/zb 58, zp 130/ zb 59

For ZPrinter 450 users, zp 130 is the High Performance Composite powder to suit all of your applications needs. Zp130 is also the powder of choice for use in legacy printers which includes the Z406 and Z810.

Zb58 and zb59 are formulated to work specifically with zp 130.

### zp 130 Key Advantages

- High feature definition
- Vibrant colors
- Good dimensional accuracy
- Great strength with infiltrated with Z-Max



### Tech Tip

It is good practice to use the plastic wiper blade scraper that comes with the machine to loosen up the bottom 3 to 4 inches of powder in the feed bed since it is less used and becomes tightly packed.

Loosen up the powder by adding a scoop or two of fresh powder.

\*Not applicable to ZPrinter 450



Figure 1: Powder Pails and Cartridges

## High Performance Composite Materials

Category	Description	Unit of Measure	Part #
Powder	zp 130 pail	22 lbs. (10 kg)	06715
	zp 130 drum	88 lbs. (40 kg)	06716
	zp 130 powder cartridge	18 lbs. (8 kg)	06926
Binder	zb 58 clear	1 gal. (3.8 L)	06660
	zb 58 cyan	½ gal. (1.9 L)	06661
	zb 58 magenta	½ gal. (1.9 L)	06662
	zb 58 yellow	½ gal. (1.9 L)	06663
	zb 59 cartridge	2 pack (1Lx2)	Z0148



Figure 2: Millenium Tower



Figure 3: Cosmic Blob

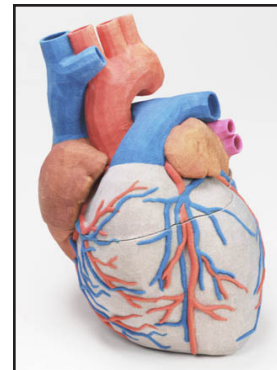


Figure 4: Heart Model



Figure 5: Architectural Model

## 2.2 zp 131/zb 60

zp 131 is the Premium Performance powder that will give you the toughest parts, the best resolution, and great color accuracy. It offers all the benefits of zp 130 with even more part quality and process improvements. zp 131 produces great looking color parts with extreme accuracy and has optimized infiltration characteristics making it even easier to infiltrate with Z-Bond™.

### zp 131 Key Advantages

#### Stronger parts

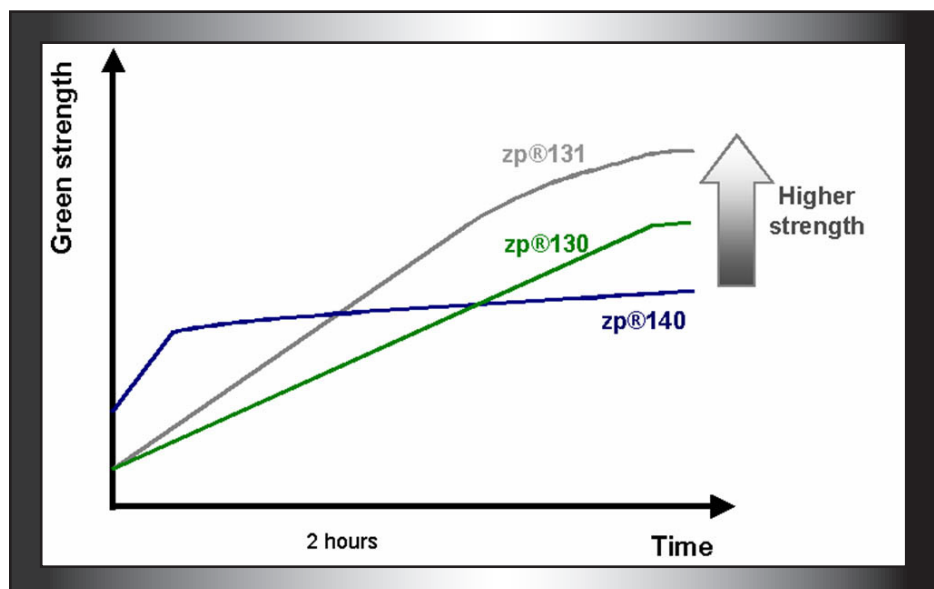
- The zp 131- Z-Bond 101 combination is on average 50% stronger than the zp 130- Z-Bond 101 combination
- Consistently stronger than zp 102
- Same great strength with Z-Max epoxy

#### Improved process

- Higher green strength: before infiltration, models are stronger, easier to extract from the build bed and fine-depowder
- More consistent infiltration when using Z-Bond 101 with great surface appearance every time
- Lower dust during handling and printing operations makes for a better work environment

#### Great color accuracy

- More neutral white: 115% whiter than zp 130\*
- Robust color gamut with more addressable colors, particularly in the light tones and color textures
- Improved color consistency and uniformity



\* per the International Commission on Illumination's Whiteness Index ( $W_{CI}E$ ), when infiltrated with Z-Bond 101

The zb 60 binder is formulated to work specifically with both zp 131 and zp 140, making it easier to swap back and forth, should your application require it.

## zb 60 Key Advantages

- Brighter, truer colors
- Improved color consistency
- Better stability
- Also compatible with zp 140

High Performance Composite Materials			
Category	Description	Unit of Measure	Part #
Powder	zp 131 pail	22 lbs. (10 kg)	06930
	zp 131 drum	88 lbs. (40 kg)	06931
Binder	zb 60 clear	1 gal. (3.8 L)	06932
	zb 60 cyan	½ gal. (1.9 L)	06933
	zb 60 magenta	½ gal. (1.9 L)	06934
	zb 60 yellow	½ gal. (1.9 L)	06935

## Tech Tip

Powder that is not printed on is recyclable, but fresh powder must periodically be cut in to maintain optimum part strength and printed dimensional accuracy.



Figure 6: DVD Player

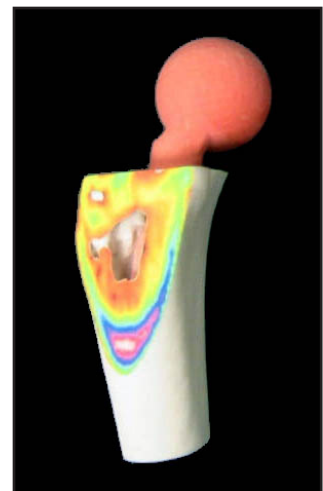


Figure 7: Femur Model



Figure 8: Valve



## 2.3 zp 140/zb 60

zp 140 is a High Performance Plus powder system that sets new limits to how easy it is to print in 3D. It features a new water cure process that makes it easier, faster and more affordable than ever to get from clicking “Print” to passing a model around at a meeting or in a classroom. This material produces high-definition 3D parts and is the material of choice for concept models.

A key advantage of the zp 140 is the water cure option. It has been specially engineered to allow parts to be post-processed by dipping them in water or spraying a fine mist on the surface. The reaction with water confers models additional strength and a smooth surface finish. The surface finish of a part cured with water is less smooth than with CA.

Because this material is so white, color 3D models printed with zp 140 feature extremely vivid color. This color can be maintained by infiltrating with standard infiltrants like Z-Bond™ or Z-Max™. Colored parts printed using the zp 140 should not be infiltrated with water as the colors will bleed. Refer to the Printers & Materials Compatibility Chart on the advantages of each powder.

zb 60 binder is formulated to work specifically with both zp 131 and zp 140, making it easier to swap back and forth, should your application require it.

### zp 140 Key Advantages:

- Water cure post-processing – easiest and safest option available
- Low cost per in<sup>3</sup>
- Brightest whites: 180% whiter than zp 130\*
- Great for concept models

### zb 60 Key Advantages:

- Better stability
- Also compatible with zp 131

High Performance Composite Materials			
Category	Description	Unit of Measure	Part #
Powder	zp 140 pail	22 lbs. (10 kg)	06936
	zp 140 drum	88 lbs. (40 kg)	06937
Binder	zb 60 clear	1 gal. (3.8 L)	06932
	zb 60 cyan	½ gal. (1.9 L)	06933
	zb 60 magenta	½ gal. (1.9 L)	06934
	zb 60 yellow	½ gal. (1.9 L)	06935

### Tech Tip

Water misting before soaking the parts helps preserve your 3D model's smallest features.

Architectural models benefit from using zp 140 infiltrated with water where true whiteness is desired.



Figure 9: Water Misting



Figure 10: Water Dipping



Figure 11: Nefertiti  
zp 140 vs. zp 130



Figure 12: Shoe Sole

\* per the International Commission on Illumination's Whiteness Index (W<sub>CIE</sub>), when infiltrated with Z-Bond 101

## 3.0 Metal Casting

### 3.1 Direct Metal Casting

The ZCast 501 Direct Metal Casting process provides the ability to produce cast metal parts from a CAD file significantly faster and less expensively than traditional prototype casting methods. Printing molds and cores directly from digital data eliminates the pattern and core box production step used in traditional sand-casting processes. Metal is poured directly into the 3D printed molds. The technology allows engineers to prototype parts in metal that are costly and time consuming to produce using traditional methods.

Direct Casting Material can be used to create sand casting molds for non-ferrous metals. This material is a blend of foundry sand, plaster, and other additives that have been combined to provide strong molds with good surface finish. It is designed to withstand the heat required to cast non-ferrous metals.

After removal from the printer, printed molds must be baked in an oven at 375°F for 4-8 hours to remove excess moisture from the mold before metal is poured. ZCast 501 molds should never be infiltrated. Common foundry products such as core paste and refractory mold wash can be used to prepare the mold for pour as they have been designed to withstand the temperatures of the casting process. Refer to the ZCast Design Guide for more details on this process.

### 3.2 Investment Casting

zp 14 Investment Casting Material can be used to quickly fabricate parts that can be dipped in wax to produce investment casting patterns. The material consists of a mix of cellulose, specialty fibers, and other additives that combine to provide an accurate part while maximizing the absorption of wax and minimizing residue during the burn-out process.

For prototyping metal parts, investment casting is possible using zp 14. The process involves printing a male pattern which is then infiltrated with wax and/or Z-Bond 11. Once infiltrated, the pattern is coated with an investment slurry, creating a mold. A cycle in the oven will burn out the printed pattern.

#### the ZCast process:

- Extremely fast turnaround from CAD file to prototype metal part
- Easily print complex molds and cores
- In-house mold-making capabilities for product manufacturers
- Simple metal-pouring process for foundries

#### Tech Tip

Investment casting: Work with your local investment casting foundry to find the proper shrinkage factor for the metal alloy used for the pour.

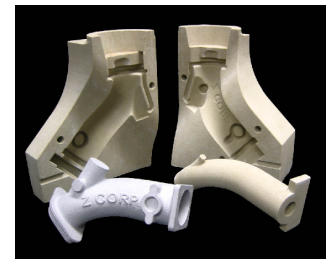


Figure 13: Metal Casting

Direct Metal Casting Materials			
Category	Description	Unit of Measure	Part #
Powder	ZCast 501 pail	33 lbs. (15 kg)	06439
	ZCast 501 drum	132 lbs. (60 kg)	06438
Binder	zb 56 clear	1 gal. (3.8 l)	06312

Investment casting materials			
Category	Description	Unit of Measure	Part #
Powder	zp 14 pail	11 lbs. (5 kg)	06127
	zp 14 drum	44 lbs. (20kg)	06128
Binder	zb 51	1 gal. (3.8 l)	05802
Infiltrant	Z-Bond 11	7.76 oz. (220 g)	15079
Infiltrant	Paraplast X-TRA	17.6 lbs. (8 kg)	10434

## 4.0 Elastomeric Material

zp 15e/zb 51 – for ZPrinter 310 and ZPrinter 310 Plus

zp 15e/zb 58 – for Spectrum Z510

Elastomeric material has been optimized for infiltration with an elastomer to create parts with rubber-like properties. The material consists of a mix of cellulose, specialty fibers, and other additives that combine to provide an accurate part capable of absorbing the elastomer, which gives the parts their rubber-like properties.

### zp 15e Key Advantages:

- Tough
- Flexible

High Performance Composite Materials			
Category	Description	Unit of Measure	Part #
Powder	zp 15e pail	9.9 lbs. (4.5 kg)	06129
Binder	zb 51 clear	1 gal. (3.8 L)	05892
	zb 58 clear	1 gal. (3.8 L)	06660
	zb 58 cyan	½ gal. (1.9 L)	06661
	zb 58 magenta	½ gal. (1.9 L)	06662
	zb 58 yellow	½ gal. (1.9 L)	06663



Figure 14: ZCorp Football



Figure 15: Flexible Shoe



Figure 16: ZCorp Ball

## 5.0 Infiltration

Infiltration is the process of applying a liquid resin to a printed part to provide strength and specific properties. Our infiltration systems have been specifically formulated to effectively penetrate the part. The lower viscosity of our infiltrants allows the resin to soak into the porous surface without leaving a thick film on the top surface.

The diagram below illustrates the open matrix of green printed Z Corp. parts. In the second drawing, the infiltrant is represented as the yellow coating applied to the surface of the matrix. Finally, the third diagram shows how the infiltrant is drawn into the part, sealing the surface area and improving the appearance and strength of the part.

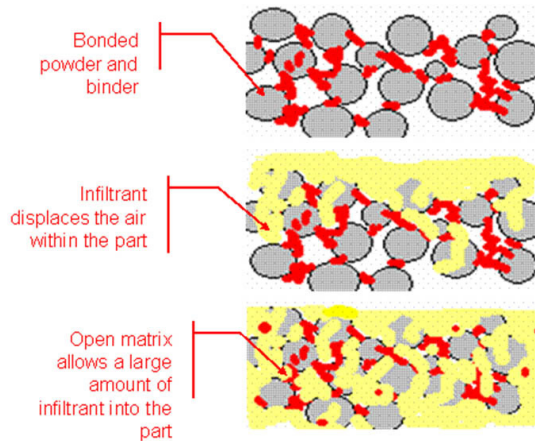
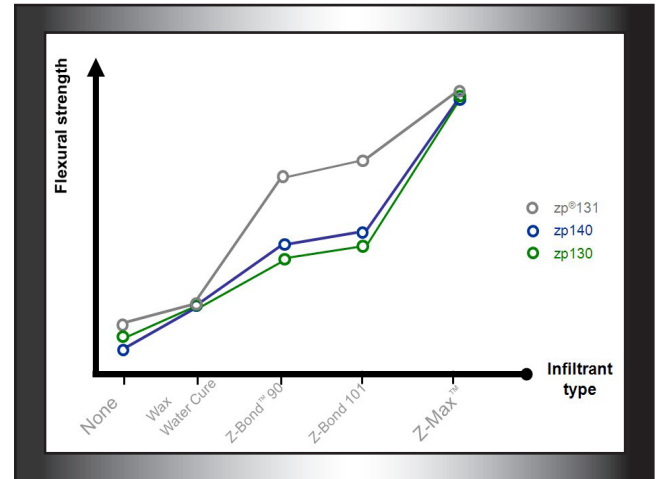


Figure 17: Infiltration Diagram

The graph below shows the flexural strength of all the powders relative to each infiltrant option. The flexural test measures the force required to bend a test specimen.



Z Corp's infiltrant line is divided into three categories, Concept Modeling, Functional and Specialty. Each infiltrant is designed to offer specific properties.

Infiltrant Guide								
Product	Description	Application Method	Color	Mix Ratio	Penetration Depth (mm)	Working time	Cure Time @ 70°F/21°C	Cure Time @ 160°F/71°C
Concept Modeling								
Z-Bond 101 Premium	Instant Cure	Dip Drizzle	Clear	-	0.5-3	-	5-10 min	-
Z-Bond 90 Economy	Instant Cure	Dip Drizzle	Clear	-	0.5-3	-	15-30 min	-
Paraplast X-TRA Wax	Seal & protect Low strength	Dip ZW3, ZW4	Clear	-	Up to 100%	-	15-30 min Cool down	-
Water Cure	Chemical-free Low strength	Mist Dip	Clear	-	Up to 100%	-	Variable	Variable
Functional								
Z-Max High Strength	Maximum Strength Heat resistant	Brush Spray	Slightly yellow	100:37 by weight	5-10	35 min	24 h	2 h
Specialty								
Por-A-Mold Elastomer	Tough Flexible	Brush	Slightly yellow	1:1 by volume	2-5	15 min	24 h	-
Z-Bond 11 Investment Casting	Instant Cure For zp14 only	Dip Drizzle	Clear	-	2-3	-	15-30 min	-
Notes: Working time is the time during which the resin can be applied, before the curing reaction starts. Cure time is the point in time when the infiltrated part is cured and has achieved full strength. ZW3 and ZW4 are waxes available from Z Corporation authorized resellers.								

## 5.1 Concept Modeling

Concept Modeling Infiltrants are great for applications ranging from design iterations, product mockups, design & ergonomics review, and proof of concept to sales/marketing tools, teaching tools or movie props.

### 5.1.1 Z-Bond 101/Z-Bond 90

**Z-Bond 101** is an extremely fast-curing infiltrant, designed to rapidly strengthen 3D-printed parts. Z-Bond 101 is a low odor formulation and is easy to apply. With Z-Bond 101 Premium Instant infiltrant, you can enjoy strong, vividly colored models in as little as 5 minutes.

Z-Bond 101 is the strongest and fastest concept modeling infiltrant and also one of the most lightfast, under office-type lighting.

Z-Bond 101 is also available in a **Dipping Kit**. This convenient kit has everything you need to easily and cleanly dip your parts. It includes 2 bottles of Z-Bond 101, a dipping container, funnel and gloves - all for the price of just the Z-Bond 101.

Z-Bond 90 is a fast-curing infiltrant for 3D-printed parts. It is a low odor formulation that makes strong and very colorful models.

Z-Bond 90 is the best value instant infiltrant and a great choice for many concept modeling applications.

### 5.1.2 Paraplast X-TRA wax

One of the most cost-effective infiltrant option for concept models is Paraplast X-TRA wax. Dipping the printed models in melted wax quickly enhances colors and fills the pores, for a smoother surface finish.

Paraplast X-TRA melts at a low temperature of 50°C (122°F) and will readily infuse the printed model and confer it some additional strength.

Paraplast X-TRA can be used with Z Corporation's ZW3 waxer and ZW4 automated waxer.

### 5.1.3 Water Cure

Water Cure is the safest and greenest way to infiltrate 3D-printed models. Simply mist your monochrome model with tap water. Water Cure is the lowest cost infiltration option and delivers the brightest white 3D models.

### CONCEPT MODELING INFILTRANT CHARACTERISTICS:

- Easy and cost effective to use
- Seal and smooth part surface
- Enhances color vibrancy
- Strengthens part for handling

### Tech Tip

A little sanding goes along way in improving the appearance of your models.

Before infiltration, take a minute to lightly sand away unevenness in the color of the part.

Once infiltrated the colors of the parts will be brighter and more uniform in appearance.



Figure 18: Z-Bond 101

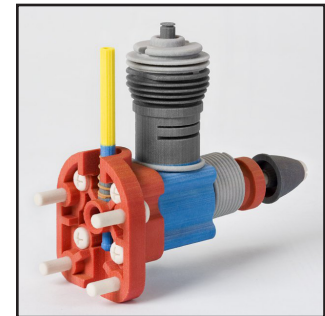


Figure 19: Small Engine



Figure 20: Architectural Model

Concept Modeling Infiltrants		
Description	Unit of Measure	Part #
Z-Bond 101 Premium small	100 g (3.53 oz.)	15078
Z-Bond 101 Premium large	454 g (16 oz.)	15077
Z-Bond 90 Economy	Pack of 2x 454 g (2x 16 oz.)	Z0096
Paraplast X-TRA	Pack of 8x 1 kg (8x 2.2 lb.)	10434
Water Cure	-	-
Z-Bond 101 Dipping Kit	2x 454 g (1 lb.) Dipping container Gloves, towels, funnel	50301



## 5.2 Functional Modeling

Functional Infiltrants are great for more demanding applications such as fit testing, functional testing, tooling or molding.

### 5.2.1 Z-Max

Z-Max is the infiltrant of choice for the user that needs prototyping functionality from their parts. A part infiltrated with Z-Max allows engineers and designers to quickly test design iterations without the cost and time associated with waiting for molded plastic parts. Once infiltrated, parts can easily be machined, tapped, sanded, and painted. Z-Max will give you a very hard, very rigid, and very strong part.

Z-Max is a high strength infiltrant. This product was formulated to support needs not met by any product currently on the market. The primary factors are convenience and performance.

Convenience: Z-Max has 35 minutes of working time, which is plenty of time to apply it and will cure without the need for an oven.

Performance: Z-Max is a low viscosity formulation, 120 cP, which means deeper, quicker penetration. The result is very strong models, up to 43 MPa of flexural strength and up to 98 MPa of compression strength. Parts made with Z-Max are hard and rigid so they don't deform under load. Z-Max also has good temperature resistance, with a Heat Deflection Temperature (HDT @ 66 psi) of 115°C. \*

Z-Max is a two-part system. In the package, both parts of the resin are supplied simply requiring mixture before use. Two sizes are available: a 250 gram pre-measured kit and a bulk .7 gallon kit.

After infiltration, Z-Max infiltrated parts cure at room temperature in 12-24 hours. The use of an oven for the cure cycle reduces the cure time to just 2 hours, producing consistently strong parts quickly.

Parts treated with Z-Max High Strength infiltrant can be sanded, drilled, tapped or machined, as needed.

### PERFORMANCE SERIES INFILTRANT CHARACTERISTICS:

- Easy and cost effective to use
- Seals part surface
- Strengthens part
- Resistant to temperature and humidity

### Tech Tip

When applying Z-Max, a heat gun is a good tool to use to retain fine feature detail.

When heat is applied to an area of the part the viscosity of the epoxy drops locally, allowing it to more easily wick in. This helps to preserve the quality of the part.



Figure 21: Z-Max

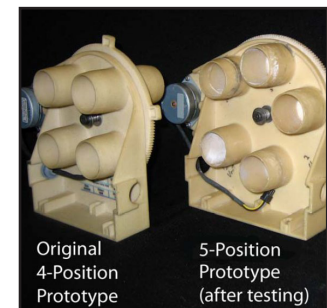


Figure 22: Vacuum Valve Assembly



Figure 23: Water Sprinkler Assembly

Functional Infiltrants		
Description	Unit of Measure	Part #
Z-Max small	250 g (8.8 oz.) Pre-weighed kit	14516
Z-Max large	2.86 kg (0.7 gal.)	14505

\* Source: Independent A2LA-accredited laboratory

## 5.3 Specialty

### 5.3.1 Por-A-Mold Elastomer

Por-A-Mold elastomer is used to give parts printed with zp 15e powder their elastomeric properties. This two part urethane is mixed and then brushed onto the part, until it is infused completely. The part must then cure at room temperature for 24 hours. This will produce a very flexible part, yielding a Shore A Hardness of  $28 \pm 2$ .

### 5.3.2 Z-Bond 11

Z-Bond 11 can be used instead of wax to prepare parts printed with zp14 before the process of investment casting or lost wax. Dipping a 3D-printed part into a hot wax bath may introduce deformation. Z-Bond 11 reacts at room temperature, to preserve the geometrical accuracy of the model and lends the pattern significantly more strength and integrity than wax would.

Note: Paraplast X-TRA can be used after infiltration with Z-Bond 11 to make the pattern's surface smoother.

Specialty Infiltrants		
Description	Unit of Measure	Part #
Por-A-Mold Elastomer	1.9 L (2 qt.)	20093
Z-Bond 11	220 g (7.76 oz.)	15079

### Tech Tip for Elastomeric Urethane

1. Mix the material in small batches
2. Apply the first coat very liberally
3. Additional coats should be lighter
4. Be ready to dab off excess material
5. Once a part has been infiltrated, be careful not to leave the part sitting in a puddle of material, as it will be difficult to cut off afterwards.



Figure 24: POR-A-MOLD



Figure 25: Applying POR-A-MOLD



Figure 26: Casting Parts

## 6.0 Resources

All consumable items can be ordered online through our Z Shop web store found in the ZCentral website, <https://zcentral.zcorp.com>. If you are not a North American customer, please contact your authorized sales representative for ordering information.

Ordering inquiries can also be directed to our Customer Development team at: [custdev@zcorp.com](mailto:custdev@zcorp.com)

Technical application inquiries can be directed to our Applications team at: [applications@zcorp.com](mailto:applications@zcorp.com)

Service related inquiries can be directed to our Service team at: [service@zcorp.com](mailto:service@zcorp.com)

Z Corp's annual User Group Meeting is another valuable resource to learn and share new applications with other 3DP users and our applications team. This conference is an invaluable networking tool for users at every level. The 2008 User Group Meeting conference is scheduled for October 5-8, 2008 in Providence, RI. Visit ZCentral and navigate to Resources/User Group Meeting for more information ([https://zcentral.zcorp.com/index.php?option=com\\_content&view=article&id=677&Itemid=134](https://zcentral.zcorp.com/index.php?option=com_content&view=article&id=677&Itemid=134)).

More information can be found in our ZCentral website:

- Latest Updates and Information
- Technical Applications Note
- Design Guides
- Best Practices
- User Training
- Knowledge Base
- Software Help
- 3DP User Group
- ZCentral Message Board
- Software and Firmware Downloads
- Product information including our line of printers and consumables